IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Chew		
Assignee:	Maxtor Corporation		
Title:	VOICE COIL FOR DISK DRIVE		
Serial No.:	09/670,261	Filed:	September 26, 2000
Examiner:	Perez, G.	Group Art Unit:	2834
Atty. Docket No.:	3123-336		

COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF
(37 C.F.R. § 1.192)

This Appeal Brief is in furtherance of the Notice of Appeal filed concurrently herewith.

Please charge the $320 fee for filing this Appeal Brief to Deposit Account No. 13-0016/336 and charge any underpayment or credit any overpayment to this Account.

This paper is submitted in triplicate.

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The index of subject matter is as follows:

I. REAL PARTY IN INTEREST

The real party in interest in this appeal is Maxtor Corporation.

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences that will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

A. Total Number of Claims in Application

Claims in the application are: 1-70

B. Status of All Claims

1.	Claims canceled:	8, 18, 21-24 and 27-30
2.	Claims withdrawn:	NONE
3.	Claims pending:	1-7, 9-17, 19, 20, 25, 26 and 31-70
4.	Claims allowed:	1-5, 11-15 and 31-50
5.	Claims objected to	25-26
5.	Claims rejected:	6, 7, 9, 10, 16, 17, 19, 20 and 51-70

C. Claims on Appeal

Claims on appeal are: 6, 7, 9, 10, 16, 17, 19, 20 and 51-70

IV. STATUS OF AMENDMENTS

No amendments have been filed after the outstanding Office Action dated August 7, 2003.

V. SUMMARY OF INVENTION

The present invention is directed to a voice coil for a disk drive.

A voice coil motor drives the actuator arm; and this motor typically includes permanent magnets mounted to the base member and a wire and bobbin coil assembly mounted on the actuator arm. The forces generated by the interaction between the magnetic field of the coil assembly and those of the permanent magnets drive the actuator arm to various positions over the disks. (Substitute Specification, page 1, lines 19-23 (fourth paragraph)).

The prior art includes a large number of actuator arm assemblies with various coil and magnet arrangements. Some of these assemblies include multiple layers of wire secured to the actuator arm with adhesive and a plurality of permanent magnets disposed proximate the wire. These constructions require complex fabrication procedures; they are susceptible to malfunction; and they do not allow easy miniaturization of the disk drive. (Substitute Specification, page 1, lines 24-28 (fifth paragraph)).

The coil assembly of the present invention avoids the disadvantages of the prior art constructions. It is a unique single-layer structure that optimizes force vectors and mass distribution. This construction provides a planar coil that allows easy installation onto an actuator arm, minimizing the cost of manufacture and assembly and enhancing miniaturization of the drive. It is a simple construction that provides consistent and efficient performance. (Substitute Specification, page 1, line 31 to page 2, line 3 (paragraph bridging pages 1 and 2)).

Disk drive apparatus A includes actuator 10 with arm 11 that supports voice coil assembly 12. (Substitute Specification, page 2, last 3 lines and Figs. 1 and 2).

Voice coil assembly 12 includes bottom insulating layer 14, middle conductive layer 15 and top insulating layer 16. (Substitute Specification, page 3, lines 10-12 and Fig. 4).

Conductive layer 15 is a single, spiraling trace that forms a generally triangular band 17 with an open center, first and second active legs, 15a and 15b, an inactive leg 15c, a first curved corner portion 15d connecting the first and second active leg portions, a second curved corner portion 15e connecting the first active leg portion with the inactive leg portion, and a third curved corner portion 15f connecting the second active leg portion with the inactive leg portion. (Substitute Specification, page 3, lines 16-21 and Fig. 2).

The first and second leg portions of the band 17 each have a predetermined width W' while the third leg portion has a width W which is smaller in magnitude than the width of the first and second leg portions. (Substitute Specification, page 3, lines 27-29 and Fig. 2).

While the spacing between each loop of the trace remains substantially the same throughout the trace, as does the height of the trace, the width varies, with the segments defining the third leg portion being substantially smaller than the segments defining the first and second leg portions. (Substitute Specification, page 3, lines 29-33 and Figs. 3 and 4).

The pivot axis of the actuator lies outwardly of the coil 12 proximate the first curved corner portion 15d. Since the third, inactive leg portion lies the furthest of the three legs from the pivot axis, it makes a substantial contribution to actuator inertia. However, it does not provide any torque in the desired direction of rotation of the actuator because it directs the force that it generates towards the actuator pivot. A reduction in the trace width (or cross-sectional area) in the third leg portion results in a reduction in mass and inertia. However, the reduction in the width is not of a magnitude that would cause a significant increase in the resistance in this portion of the trace. (Substitute Specification, page 3, line 34 to page 4, line 6 (paragraph bridging pages 3 and 4)).

VI. ISSUES

The issues on appeal are (1) whether claims 6, 7, 9, 10, 16, 17, 19, 20, 51-62 and 64-70 are unpatentable under 35 U.S.C. § 103(a) over *Rao* (U.S. Patent 6,040,650) in view of *Sawada* (U.S. Patent 5,099,162), and (2) whether claim 63 is unpatentable under 35 U.S.C. § 103(a) over *Rao* in view of *Sawada* and *Yamamoto et al.* (U.S. 4,728,390).

VII. GROUPING OF CLAIMS

For the first issue, the claims stand and fall together.

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VIII. ARGUMENTS

I. SECTION 103 REJECTIONS – RAO AND SAWADA

Claims 6, 7, 9, 10, 16, 17, 19, 20, 51-62 and 64-70 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Rao* (U.S. Patent 6,040,650)[1] in view of *Sawada* (U.S. Patent 5,099,162).

Rao

Rao discloses stator windings for electric machines such as brushless and brushed type DC motors and generators.

Prior art axial gap motor 10 includes rotating permanent magnet disks 1 and 2 and stator ring 3. Permanent magnet disks 1 and 2 are separated from stator ring 3 by air gaps 4 and 5 as they rotate about central axis 7 of rotor axle 12. Permanent magnet disks 1 and 2 are supported by iron rings 13 and 14, and stator ring 3 is supported by housing 15.

Stator ring 3 contains multiple sets of sector-shaped coils 20 that each contain radial sections 22a and 22b and inactive sections 26 and 27. Coils 20 with uniform cross-section conductors provide empty areas 24 that cause loss of useful area resulting in loss of torque.

Rao reduces the air gap between the magnets to increase torque by reducing the axial thickness of the stator windings. The stator windings have plural coils that are assembled arcuately adjacent to one another with the active sectors of the radial sections in an essentially coplanar configuration and having tapered conductors that increase in width in the radial direction. The tapered conductors permit more conductors to be placed side by side.

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[1] The Examiner states that U.S. Patent 6,040,650 is a continuation-in-part of U.S. Patent 5,982,069 and refers to both patents in sustaining the rejections. As best Applicant can tell, the issues on appeal are the same regardless of whether the '650 patent or the '069 patent is cited. Therefore, Applicant will discuss the '650 patent.

Phase coil 30 includes radial sections 31a and 31b, inner section 32 and outer section 33. Radial sections 31a and 31b include tapered electrical conductors that have increasing width as they progress from the inner radius to the outer radius. Radial sections 31a and 31b can have uniform width as they extend along the inner and outer radius and run essentially in lines around the axis of rotation of the rotor. Radial sections 31a and 31b can have a constant cross-sectional area by increasing and decreasing the thickness of the conductor as the width is decreased and increased respectively to give uniform resistance to current flow. Alternatively, the thickness of the conductor can remain constant as the width expands so long as the cross-sectional area is sufficient to carry the current load.

Fig. 3 illustrates the inner radius r_i, median radius r_m and outer radius r_o of the permanent magnets of the rotor superimposed on phase coil 30. Thus, phase coil 30 is part of the stator.

Fig. 4a illustrates first winding sheet 40, and Fig. 4b illustrates second winding sheet 42. First winding sheet 40 includes nine phase coils 30 uniformly spaced about central axis 7 and formed on carrier film 43. Second winding sheet 42 is identical to first winding sheet 40 except that it is angularly shifted about central axis 7.

Fig. 5 illustrates winding lamination 50 that results from laminating together winding sheets 40 and 42. The active coil sectors of first winding sheet 40 fit within the open area of second winding sheet 42, and the active coil sectors of second winding sheet 42 fit within the open area of first winding sheet 40. As a result, almost the entire area is covered with active conductor wires.

Rao discloses that the stator can be used in a disk drive:

> Motors using the structure of the invention can be used in many applications such as locomotive traction motors, hybrid electric drives, underwater vehicles, tanks, ships, aircraft generators, stationary power sources, disc drives, etc. (Col. 3, lines 61-65.)

Rao says nothing about the stator being a voice coil in a disk drive.

Sawada

Sawada discloses a coil structure for motors and generators that prevents perfect diamagnetism caused by superconducting material in the coil.

Fig. 7 illustrates coil substrate 28 and coil patterns 30.

The coils are manufactured by providing a silicon wafer, oxidizing the wafer, depositing a ceramic thin film of superconducting material by chemical vapor deposition, sputtering or electron beam deposition on the oxidation layer, coating photoresist on the ceramic thin film, dry etching the ceramic thin film using the photoresist as an etch mask, and removing the photoresist. Coil substrate 28 is the oxidation layer, and coil patterns 30 are remaining portions of the ceramic thin film.

Claims

Claim 6 recites "A voice coil for a disk drive comprising: a rotatable spiral winding of conductive material . . . with a generally triangular shape with an open center." Claims 16, 51 and 67 recite similar limitations.

Rao fails to teach or suggest a voice coil for a disk drive. Although *Rao* discloses that a motor with winding lamination 50 can be used in a disk drive (col. 3, lines 61-65), *Rao* says nothing about the motor being a voice coil motor. Disk drives also contain spindle motors for rotating the disks.

Rao also fails to teach or suggest that winding lamination 50 is rotatable. Instead, *Rao* discloses that winding lamination 50 is a stator for a three-phase motor.

Rao also fails to teach or suggest that winding lamination 50 has a generally triangular shape. Instead, *Rao* discloses that winding lamination 50 has a generally circular shape. Likewise, *Rao* also fails to teach or suggest that phase coil 30 has an open center. Instead, *Rao* discloses that phase coil 30 has a covered center, covered by another phase coil in winding lamination 50.

Sawada fails to cure these deficiencies.

In sustaining these rejections, the Examiner states as follows:

> Referring to claim 6, *Rao* discloses a voice coil for a disk drive comprising:
>
> a spiral winding of conductive material (figure 3) defining a flat band (figure 6) with a generally triangular shape (figure 3) with an open center, first and second active leg portions (31a, 31b) and an inactive leg portion (33) . . .
>
> However, Rao does not disclose that the winding rotates.
>
> Sawada discloses that winding can be made fixed or rotate (figures 8A and 9A) to provide torque to an external load.
>
> It would have been obvious at the time the invention was made to modify the actuator of Rao to make it an either rotating winding actuator or a fixed winding actuator and still be capable of providing torque to an external load.

The rejection is flawed for several reasons.

First, *Rao* is non-analogous to the present invention. *Rao* is directed to a three phase stator winding in which tapered coils allow densely packed coils to reduce unused area between the coils, whereas the present invention is directed to a rotatable voice coil in which a spiral winding with tapered segments reduces mass and inertia. In order to be analogous art, the reference must either be in the field of the invention or be reasonably pertinent to the particular problem with which the inventor was concerned (M.P.E.P. § 2141.01(a)). *Rao* is neither within the field of the invention (a rotatable voice coil) nor pertinent to the particular problem with which the inventor was concerned (reduced mass and inertia). Therefore, *Rao* is non-analogous to the present invention and cannot be used to sustain an obviousness rejection.

Second, *Sawada* fails to teach or suggest that winding lamination 50 in *Rao* can be a rotor. *Sawada* discloses that coils composed of ceramic thin film deposited on an oxidation layer by chemical vapor deposition, sputtering or electron beam deposition can provide a rotor. However, *Sawada* fails to teach or suggest that a winding lamination structure potted in epoxy has enough mechanical robustness to provide a rotor. *Rao* discloses that winding lamination 50 is potted in epoxy to form a rigid stator. However, neither *Rao* nor *Sawada* teach or suggest that winding lamination 50 has the mechanical robustness to provide a rotor. Rotating winding lamination 50 could detach or displace winding sheets 40 and 42, which would damage or destroy the motor. Thus, there is no teaching, suggestion or motivation for the proposed modification.

Third, even if *Rao* was modified so that winding lamination 50 was rotatable, winding lamination 50 (1) would not provide a voice coil for a disk drive, and (2) would not include a rotatable spiral winding of conductive material with a generally triangular shape with an open center.

A voice coil for a disk drive arises in a voice coil motor that drives an actuator arm to various positions over a disk. The voice coil motor includes the voice coil and a permanent magnet that generates a magnetic field. The voice coil and the actuator arm are mounted on opposite sides of a pivot assembly. When current is applied to the voice coil, the voice coil and the magnetic field interact to generate force that rotates the voice coil about the pivot assembly, thereby rotating the actuator arm about the pivot assembly. This conventional structure and operation is well-known to those skilled in the art. *Rao*, on the other hand, teaches that winding lamination 50 includes phase coils 30 uniformly dispersed about central axis 7, as is conventional for a stator in a three phase motor. *Rao* fails to teach or suggest providing phase coils 30 on only a single side of central axis 7. Thus, winding lamination 50 is not suitable as a voice coil for a disk drive. *Rao* also fails to teach or suggest using a single phase coil 30 as the stator, particularly since this would contradict the stated objective of reducing open area within the coil.

Rao discloses that winding lamination 50 can be used in a disk drive, however *Rao* fails to teach or suggest that winding lamination 50 provides a voice coil in a disk drive. Those skilled in the art would recognize that winding lamination 50 can be used as a stator in a spindle motor in a disk drive, but would have no reason to believe that winding lamination 50 (or phase coil 30) could provide a voice coil in a disk drive.

Rao discloses that phase coil 30 has an open center, however winding lamination 50 contains many phase coils 30, and each phase coil 30 has its open area filled by another phase coil 30. *Rao* fails to teach or suggest that phase coil 30 in winding lamination 50 has an open center.

To establish a prima facie case of obviousness (1) there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings; (2) there must be a reasonable expectation of success; and (3) the prior art reference (or references when combined) must teach or suggest all the claim limitations (MPEP § 2143). See also *C.R. Bard, Inc. v. M3 Systems, Inc.*, 157 F.3d 1340, 1351 (Fed. Cir. 1998).

It is insufficient that the prior art shows similar components unless it also contains some teaching, suggestion or incentive for arriving at the claimed structure. See *Northern Telecom, Inc. v. Datapoint Corp.*, 908 F.2d 931, 934 (Fed. Cir. 1990).

Moreover, if the proposed modification would render the prior art unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification (M.P.E.P. § 2143.01).

II. SECTION 103 REJECTIONS – RAO, SAWADA AND YAMAMOTO ET AL.

Claim 63 is rejected under 35 U.S.C. § 103(a) as being unpatentable over *Rao* in view of *Sawada* and *Yamamoto et al.* (U.S. 4,728,390).

Claim 63 distinguishes over *Rao* in view of *Sawada* and *Yamamoto et al.* for the reasons set forth above for claim 6.

CONCLUSION

For the reasons given above, Applicant respectfully submits that claims 6, 7, 9, 10, 16, 17, 19, 20 and 51-70 are in condition for allowance and respectfully requests that the outstanding rejections be overturned.

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on September 10, 2003.
D Sigmond — 9/10/03
David M. Sigmond, Attorney for Applicant — Date of Signature

Respectfully submitted,

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IX. APPENDIX OF CLAIMS INVOLVED IN THE APPEAL

6. A voice coil for a disk drive comprising: a rotatable spiral winding of conductive material defining a flat band with a generally triangular shape with an open center, first and second active leg portions and an inactive leg portion, a first curved corner portion connecting the first and second active leg portions, a second curved corner portion connecting the first active leg portion with the inactive leg portion, and a third curved corner portion connecting the second active leg portion with the inactive leg portion, the cross-sectional area of the band varying along its length.

7. The coil of claim 6, wherein the cross-sectional area of each of the segments that define the inactive leg portion is smaller than the cross-sectional area of each of the remaining segments that define the first and second active leg portions.

9. The coil of claim 6, wherein the radius of curvature of the first curved corner portion is greater than the radius of curvature of the second and third curved corner portions.

10. The coil of claim 9, wherein the radius of curvature of the second curved corner portion is equal to the radius of curvature of the third curved corner portion.

16. In combination with an actuator member in a disk drive, a voice coil secured to a face of the actuator member, said voice coil comprising a continuous rotatable spiral winding of wire defining a flat band with a generally triangular shape with an open center, first and second active leg portions and an inactive leg portion, a first curved corner portion connecting the first and second active leg portions, a second curved corner portion connecting the first active leg portion with the inactive leg portion, and a third curved corner portion connecting the second active leg portion with the inactive leg portion, the cross-sectional area of the band varying along its length.

17. The coil of claim 16, wherein the cross-sectional area of the segments that define the inactive leg portion is smaller than the cross-sectional area of the remaining segments that define the first and second active leg portions.

19. The coil of claim 16, wherein the radius of curvature of the first curved corner portion is greater than the radius of curvature of the second and third curved corner portions.

20. The coil of claim 19, wherein the radius of curvature of the second curved corner portion is equal to the radius of curvature of the third curved corner portion.

51. A voice coil for driving an actuator arm to various positions over a disk of a disk drive, the voice coil comprising:

a rotatable spiral winding of conductive material defining a band with a generally triangular shape having an open center, wherein the spiral winding includes:

a first active leg portion defined by segments having a first cross-sectional area;

a second active leg portion defined by segments having a second cross-sectional area;

an inactive leg portion defined by segments having a third cross-sectional area, wherein the third cross-sectional area is smaller than the first cross-sectional area, and the third cross-sectional area is smaller than the second cross-sectional area;

a first curved corner portion connecting the first and second active leg portions;

a second curved corner portion connecting the first active leg portion and the inactive leg portion; and

a third curved corner portion connecting the second active leg portion and the inactive leg portion.

52. The voice coil of claim 51, wherein the spiral winding is a planar coil.

53. The voice coil of claim 51, wherein the spiral winding is a single-layer coil.

54. The voice coil of claim 51, wherein the spiral winding is a planar single-layer coil.

55. The voice coil of claim 51, wherein the spacing between each loop of the spiral winding remains substantially the same throughout the spiral winding.

56. The voice coil of claim 51, wherein the height of the spiral winding remains substantially the same throughout the spiral winding.

57. The voice coil of claim 51, wherein the spacing between each loop of the spiral winding remains substantially the same throughout the spiral winding, and the height of the spiral winding remains substantially the same throughout the spiral winding.

58. The voice coil of claim 51, wherein a width of the segments defining the inactive leg portion is substantially smaller than a width of the segments defining the first and second active leg portions.

59. The voice coil of claim 58, wherein a width of the segments defining the first active leg portion is the same as a width of the segments defining the second active leg portion.

60. The voice coil of claim 51, wherein the cross-sectional area of the segments defining the inactive leg portion is substantially smaller than the cross-sectional area of the segments defining the first and second active leg portions.

61. The voice coil of claim 60, wherein the cross-sectional area of the segments defining the first active leg portion is the same as the cross-sectional area of the segments defining the second active leg portion.

62. The voice coil of claim 51, further comprising a top insulative layer and a bottom insulative layer, wherein the spiral winding is sandwiched between the top and bottom insulative layers.

63. The voice coil of claim 62, wherein the top and bottom insulative layers are polyimide and the spiral winding is copper.

64. The voice coil of claim 62, wherein the top insulative layer is secured to the spiral winding by an adhesive.

65. The voice coil of claim 62, wherein the bottom insulative layer is secured to the spiral winding by an adhesive.

66. The voice coil of claim 62, wherein the top and bottom insulative layers are secured to the spiral winding by adhesives.

67. A voice coil for driving an actuator arm to various positions over a disk of a disk drive, the voice coil comprising:

a rotatable spiral winding of conductive material defining a flat band with a generally triangular shape having an open center, wherein the spiral winding is adapted to interact with the magnetic field of permanent magnets of the disk drive, and the spiral winding is a continuous planar single-layer coil that includes:

a first active leg portion defined by segments having a first cross-sectional area;

a second active leg portion defined by segments having a second cross-sectional area;

an inactive leg portion defined by segments having a third cross-sectional area, wherein the third cross-sectional area is smaller than the first cross-sectional area, and the third cross-sectional area is smaller than the second cross-sectional area;

a first curved corner portion connecting the first and second active leg portions;

a second curved corner portion connecting the first active leg portion and the inactive leg portion; and

a third curved corner portion connecting the second active leg portion and the inactive leg portion.

68. The voice coil of claim 67, wherein the spacing between each loop of the spiral winding remains substantially the same throughout the spiral winding, and the height of the spiral winding remains substantially the same throughout the spiral winding.

69. The voice coil of claim 67, wherein the cross-sectional area of the segments defining the inactive leg portion is substantially smaller than the cross-sectional area of the segments defining the first and second active leg portions, and a cross-sectional area of the segments defining the first active leg portion is the same as a cross-sectional area of the segments defining the second active leg portion.

70. The voice coil of claim 67, further comprising a top insulative layer and a bottom insulative layer, wherein the spiral winding is sandwiched between the top and bottom insulative layers and secured to the top and bottom insulative layers by adhesives.

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[1] The Examiner states that U.S. Patent 6,040,650 is a continuation-in-part of U.S. Patent 5,982,069 and refers to both patents in sustaining the rejections. As best Applicant can tell, the issues on appeal are the same regardless of whether the '650 patent or the '069 patent is cited. Therefore, Applicant will discuss the '650 patent.

Phase coil 30 includes radial sections 31a and 31b, inner section 32 and outer section 33. Radial sections 31a and 31b include tapered electrical conductors that have increasing width as they progress from the inner radius to the outer radius. Radial sections 31a and 31b can have uniform width as they extend along the inner and outer radius and run essentially in lines around the axis of rotation of the rotor. Radial sections 31a and 31b can have a constant cross-sectional area by increasing and decreasing the thickness of the conductor as the width is decreased and increased respectively to give uniform resistance to current flow. Alternatively, the thickness of the conductor can remain constant as the width expands so long as the cross-sectional area is sufficient to carry the current load.

Fig. 3 illustrates the inner radius r_i, median radius r_m and outer radius r_o of the permanent magnets of the rotor superimposed on phase coil 30. Thus, phase coil 30 is part of the stator.

Fig. 4a illustrates first winding sheet 40, and Fig. 4b illustrates second winding sheet 42. First winding sheet 40 includes nine phase coils 30 uniformly spaced about central axis 7 and formed on carrier film 43. Second winding sheet 42 is identical to first winding sheet 40 except that it is angularly shifted about central axis 7.

Fig. 5 illustrates winding lamination 50 that results from laminating together winding sheets 40 and 42. The active coil sectors of first winding sheet 40 fit within the open area of second winding sheet 42, and the active coil sectors of second winding sheet 42 fit within the open area of first winding sheet 40. As a result, almost the entire area is covered with active conductor wires.

Rao discloses that the stator can be used in a disk drive:

> Motors using the structure of the invention can be used in many applications such as locomotive traction motors, hybrid electric drives, underwater vehicles, tanks, ships, aircraft generators, stationary power sources, disc drives, etc. (Col. 3, lines 61-65.)

Rao says nothing about the stator being a voice coil in a disk drive.

Sawada

Sawada discloses a coil structure for motors and generators that prevents perfect diamagnetism caused by superconducting material in the coil.

Fig. 7 illustrates coil substrate 28 and coil patterns 30.

The coils are manufactured by providing a silicon wafer, oxidizing the wafer, depositing a ceramic thin film of superconducting material by chemical vapor deposition, sputtering or electron beam deposition on the oxidation layer, coating photoresist on the ceramic thin film, dry etching the ceramic thin film using the photoresist as an etch mask, and removing the photoresist. Coil substrate 28 is the oxidation layer, and coil patterns 30 are remaining portions of the ceramic thin film.

Claims

Claim 6 recites "A voice coil for a disk drive comprising: a rotatable spiral winding of conductive material . . . with a generally triangular shape with an open center." Claims 16, 51 and 67 recite similar limitations.

Rao fails to teach or suggest a voice coil for a disk drive. Although *Rao* discloses that a motor with winding lamination 50 can be used in a disk drive (col. 3, lines 61-65), *Rao* says nothing about the motor being a voice coil motor. Disk drives also contain spindle motors for rotating the disks.

Rao also fails to teach or suggest that winding lamination 50 is rotatable. Instead, *Rao* discloses that winding lamination 50 is a stator for a three-phase motor.

Rao also fails to teach or suggest that winding lamination 50 has a generally triangular shape. Instead, *Rao* discloses that winding lamination 50 has a generally circular shape. Likewise, *Rao* also fails to teach or suggest that phase coil 30 has an open center. Instead, *Rao* discloses that phase coil 30 has a covered center, covered by another phase coil in winding lamination 50.

Sawada fails to cure these deficiencies.

In sustaining these rejections, the Examiner states as follows:

> Referring to claim 6, *Rao* discloses a voice coil for a disk drive comprising:
>
> a spiral winding of conductive material (figure 3) defining a flat band (figure 6) with a generally triangular shape (figure 3) with an open center, first and second active leg portions (31a, 31b) and an inactive leg portion (33) . . .
>
> However, Rao does not disclose that the winding rotates.
>
> Sawada discloses that winding can be made fixed or rotate (figures 8A and 9A) to provide torque to an external load.
>
> It would have been obvious at the time the invention was made to modify the actuator of Rao to make it an either rotating winding actuator or a fixed winding actuator and still be capable of providing torque to an external load.

The rejection is flawed for several reasons.

First, *Rao* is non-analogous to the present invention. *Rao* is directed to a three phase stator winding in which tapered coils allow densely packed coils to reduce unused area between the coils, whereas the present invention is directed to a rotatable voice coil in which a spiral winding with tapered segments reduces mass and inertia. In order to be analogous art, the reference must either be in the field of the invention or be reasonably pertinent to the particular problem with which the inventor was concerned (M.P.E.P. § 2141.01(a)). *Rao* is neither within the field of the invention (a rotatable voice coil) nor pertinent to the particular problem with which the inventor was concerned (reduced mass and inertia). Therefore, *Rao* is non-analogous to the present invention and cannot be used to sustain an obviousness rejection.

Second, *Sawada* fails to teach or suggest that winding lamination 50 in *Rao* can be a rotor. *Sawada* discloses that coils composed of ceramic thin film deposited on an oxidation layer by chemical vapor deposition, sputtering or electron beam deposition can provide a rotor. However, *Sawada* fails to teach or suggest that a winding lamination structure potted in epoxy has enough mechanical robustness to provide a rotor. *Rao* discloses that winding lamination 50 is potted in epoxy to form a rigid stator. However, neither *Rao* nor *Sawada* teach or suggest that winding lamination 50 has the mechanical robustness to provide a rotor. Rotating winding lamination 50 could detach or displace winding sheets 40 and 42, which would damage or destroy the motor. Thus, there is no teaching, suggestion or motivation for the proposed modification.

Third, even if *Rao* was modified so that winding lamination 50 was rotatable, winding lamination 50 (1) would not provide a voice coil for a disk drive, and (2) would not include a rotatable spiral winding of conductive material with a generally triangular shape with an open center.

A voice coil for a disk drive arises in a voice coil motor that drives an actuator arm to various positions over a disk. The voice coil motor includes the voice coil and a permanent magnet that generates a magnetic field. The voice coil and the actuator arm are mounted on opposite sides of a pivot assembly. When current is applied to the voice coil, the voice coil and the magnetic field interact to generate force that rotates the voice coil about the pivot assembly, thereby rotating the actuator arm about the pivot assembly. This conventional structure and operation is well-known to those skilled in the art. *Rao*, on the other hand, teaches that winding lamination 50 includes phase coils 30 uniformly dispersed about central axis 7, as is conventional for a stator in a three phase motor. *Rao* fails to teach or suggest providing phase coils 30 on only a single side of central axis 7. Thus, winding lamination 50 is not suitable as a voice coil for a disk drive. *Rao* also fails to teach or suggest using a single phase coil 30 as the stator, particularly since this would contradict the stated objective of reducing open area within the coil.

Rao discloses that winding lamination 50 can be used in a disk drive, however *Rao* fails to teach or suggest that winding lamination 50 provides a voice coil in a disk drive. Those skilled in the art would recognize that winding lamination 50 can be used as a stator in a spindle motor in a disk drive, but would have no reason to believe that winding lamination 50 (or phase coil 30) could provide a voice coil in a disk drive.

Rao discloses that phase coil 30 has an open center, however winding lamination 50 contains many phase coils 30, and each phase coil 30 has its open area filled by another phase coil 30. *Rao* fails to teach or suggest that phase coil 30 in winding lamination 50 has an open center.

To establish a prima facie case of obviousness (1) there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings; (2) there must be a reasonable expectation of success; and (3) the prior art reference (or references when combined) must teach or suggest all the claim limitations (MPEP § 2143). See also *C.R. Bard, Inc. v. M3 Systems, Inc.*, 157 F.3d 1340, 1351 (Fed. Cir. 1998).

It is insufficient that the prior art shows similar components unless it also contains some teaching, suggestion or incentive for arriving at the claimed structure. See *Northern Telecom, Inc. v. Datapoint Corp.*, 908 F.2d 931, 934 (Fed. Cir. 1990).

Moreover, if the proposed modification would render the prior art unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification (M.P.E.P. § 2143.01).

II. SECTION 103 REJECTIONS – RAO, SAWADA AND YAMAMOTO ET AL.

Claim 63 is rejected under 35 U.S.C. § 103(a) as being unpatentable over *Rao* in view of *Sawada* and *Yamamoto et al.* (U.S. 4,728,390).

Claim 63 distinguishes over *Rao* in view of *Sawada* and *Yamamoto et al.* for the reasons set forth above for claim 6.

CONCLUSION

For the reasons given above, Applicant respectfully submits that claims 6, 7, 9, 10, 16, 17, 19, 20 and 51-70 are in condition for allowance and respectfully requests that the outstanding rejections be overturned.

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on September 10, 2003.

D Sigmond 9/10/03

David M. Sigmond
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Date of Signature

Respectfully submitted,

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IX. APPENDIX OF CLAIMS INVOLVED IN THE APPEAL

6. A voice coil for a disk drive comprising: a rotatable spiral winding of conductive material defining a flat band with a generally triangular shape with an open center, first and second active leg portions and an inactive leg portion, a first curved corner portion connecting the first and second active leg portions, a second curved corner portion connecting the first active leg portion with the inactive leg portion, and a third curved corner portion connecting the second active leg portion with the inactive leg portion, the cross-sectional area of the band varying along its length.

7. The coil of claim 6, wherein the cross-sectional area of each of the segments that define the inactive leg portion is smaller than the cross-sectional area of each of the remaining segments that define the first and second active leg portions.

9. The coil of claim 6, wherein the radius of curvature of the first curved corner portion is greater than the radius of curvature of the second and third curved corner portions.

10. The coil of claim 9, wherein the radius of curvature of the second curved corner portion is equal to the radius of curvature of the third curved corner portion.

16. In combination with an actuator member in a disk drive, a voice coil secured to a face of the actuator member, said voice coil comprising a continuous rotatable spiral winding of wire defining a flat band with a generally triangular shape with an open center, first and second active leg portions and an inactive leg portion, a first curved corner portion connecting the first and second active leg portions, a second curved corner portion connecting the first active leg portion with the inactive leg portion, and a third curved corner portion connecting the second active leg portion with the inactive leg portion, the cross-sectional area of the band varying along its length.

17. The coil of claim 16, wherein the cross-sectional area of the segments that define the inactive leg portion is smaller than the cross-sectional area of the remaining segments that define the first and second active leg portions.

19. The coil of claim 16, wherein the radius of curvature of the first curved corner portion is greater than the radius of curvature of the second and third curved corner portions.

20. The coil of claim 19, wherein the radius of curvature of the second curved corner portion is equal to the radius of curvature of the third curved corner portion.

51. A voice coil for driving an actuator arm to various positions over a disk of a disk drive, the voice coil comprising:

a rotatable spiral winding of conductive material defining a band with a generally triangular shape having an open center, wherein the spiral winding includes:

a first active leg portion defined by segments having a first cross-sectional area;

a second active leg portion defined by segments having a second cross-sectional area;

an inactive leg portion defined by segments having a third cross-sectional area, wherein the third cross-sectional area is smaller than the first cross-sectional area, and the third cross-sectional area is smaller than the second cross-sectional area;

a first curved corner portion connecting the first and second active leg portions;

a second curved corner portion connecting the first active leg portion and the inactive leg portion; and

a third curved corner portion connecting the second active leg portion and the inactive leg portion.

52. The voice coil of claim 51, wherein the spiral winding is a planar coil.

53. The voice coil of claim 51, wherein the spiral winding is a single-layer coil.

54. The voice coil of claim 51, wherein the spiral winding is a planar single-layer coil.

55. The voice coil of claim 51, wherein the spacing between each loop of the spiral winding remains substantially the same throughout the spiral winding.

56. The voice coil of claim 51, wherein the height of the spiral winding remains substantially the same throughout the spiral winding.

57. The voice coil of claim 51, wherein the spacing between each loop of the spiral winding remains substantially the same throughout the spiral winding, and the height of the spiral winding remains substantially the same throughout the spiral winding.

58. The voice coil of claim 51, wherein a width of the segments defining the inactive leg portion is substantially smaller than a width of the segments defining the first and second active leg portions.

59. The voice coil of claim 58, wherein a width of the segments defining the first active leg portion is the same as a width of the segments defining the second active leg portion.

60. The voice coil of claim 51, wherein the cross-sectional area of the segments defining the inactive leg portion is substantially smaller than the cross-sectional area of the segments defining the first and second active leg portions.

61. The voice coil of claim 60, wherein the cross-sectional area of the segments defining the first active leg portion is the same as the cross-sectional area of the segments defining the second active leg portion.

62. The voice coil of claim 51, further comprising a top insulative layer and a bottom insulative layer, wherein the spiral winding is sandwiched between the top and bottom insulative layers.

63. The voice coil of claim 62, wherein the top and bottom insulative layers are polyimide and the spiral winding is copper.

64. The voice coil of claim 62, wherein the top insulative layer is secured to the spiral winding by an adhesive.

65. The voice coil of claim 62, wherein the bottom insulative layer is secured to the spiral winding by an adhesive.

66. The voice coil of claim 62, wherein the top and bottom insulative layers are secured to the spiral winding by adhesives.

67. A voice coil for driving an actuator arm to various positions over a disk of a disk drive, the voice coil comprising:

a rotatable spiral winding of conductive material defining a flat band with a generally triangular shape having an open center, wherein the spiral winding is adapted to interact with the magnetic field of permanent magnets of the disk drive, and the spiral winding is a continuous planar single-layer coil that includes:

a first active leg portion defined by segments having a first cross-sectional area;

a second active leg portion defined by segments having a second cross-sectional area;

an inactive leg portion defined by segments having a third cross-sectional area, wherein the third cross-sectional area is smaller than the first cross-sectional area, and the third cross-sectional area is smaller than the second cross-sectional area;

a first curved corner portion connecting the first and second active leg portions;

a second curved corner portion connecting the first active leg portion and the inactive leg portion; and

a third curved corner portion connecting the second active leg portion and the inactive leg portion.

68. The voice coil of claim 67, wherein the spacing between each loop of the spiral winding remains substantially the same throughout the spiral winding, and the height of the spiral winding remains substantially the same throughout the spiral winding.

69. The voice coil of claim 67, wherein the cross-sectional area of the segments defining the inactive leg portion is substantially smaller than the cross-sectional area of the segments defining the first and second active leg portions, and a cross-sectional area of the segments defining the first active leg portion is the same as a cross-sectional area of the segments defining the second active leg portion.

70. The voice coil of claim 67, further comprising a top insulative layer and a bottom insulative layer, wherein the spiral winding is sandwiched between the top and bottom insulative layers and secured to the top and bottom insulative layers by adhesives.